Emerging Trends and Impacts of the rise of AI, Data Analytics and Blockchain

Special issue call for papers from Journal of Enterprise Information Management (JEIM)

1. Introduction

There are emerging trends and impacts due to the rise of Artificial Intelligence (AI), Data Analytics and Blockchain as described as follows. AI-driven applications are rapidly increasing for businesses and governments globally, and they enable different functions of services to work efficiently and allow multi-tasking. Reporting outcomes can be further assisted by Data Analytics, which present scientific and business outputs in graphs and visualization based on the extraction and analysis of complex datasets (Keim et al., 2008; Chang, 2018 a; 2018 b). Behind the development of Data analytics, smart algorithms can quickly and efficiently process large data and extract the most meaningful data to report to decision-makers (Chang et al., 2019). The use of Blockchain can enhance security, privacy and optimization of the entire services since Blockchain offers secure application development with smart contracts and its distributed Fintech technology (Alketbi et al., 2018; Kaur et al., 2018; Zeng, 2018). Integration of AI, Data Analytics and Blockchain can be essential for the new development of pioneering research (Mamoshina et al., 2018; Zeng, 2018). For example, in driverless cars, their integration makes impacts so that we can predict drivers' intents (Birek et al., 2018). In another example, the integration can enable multi-disciplinary research in healthcare, finance, weather studies and natural disasters (Chang, 2018 b).

In other words, the integration of AI, Data Analytics and Blockchain can produce greater impacts and availability of different services, such as 5G, IoT, Cloud, Fintech, Cybersecurity and Software Engineering (Skilton and Hovsepian, 2017; Gai et al., 2018; Mohamed and Ali, 2018; Chang et al., 2019 b; Saha, 2019). The integrated services have emerged to tackle large-scale standalone IT facilities for improving computational efficiency and reducing cost. This also transforms the way Software Engineering has been developed since service-oriented architecture can offer a framework for service components, a natural attribute of distributed ledger services to make more impacts offered by AI, Data Analytics, Blockchain, and its integrated uses.

2. Paper selection process

In this special issue (SI), we were interested in discovering and promoting the latest trends, adoption cases, techniques, innovation, case studies and real-world solutions individually for AI, Data Analytics and Blockchain, as well as its integrated uses and new development of the related areas such Software Engineering, IoT-Fog-Edge-Cloud Computing and Cybersecurity. Apart from quantitative research methods, we welcomed papers with innovative mixed and qualitative methods and high-quality and

unpublished papers for this SI submission. The guest editors were particularly interested in papers on emerging technologies topics, including AI, Internet of Things, Big Data, Blockchain, as well as their impacts, recommendations and adoption cases. The papers included in this special issue aim to discover and promote the latest trends, adoption cases, techniques, innovation, case studies and real-world solutions individually for AI, Data Analytics and Blockchain, and their integrated uses. Apart from quantitative research methods, we welcome papers with innovative mixed and qualitative methods.

Manuscripts should not have been previously published or be under review in other journals. Outstanding papers presented at International Conference on Industrial IoT, Big Data and Supply Chain 2020 (IIoTBDSC 2020) were selected. We also welcomed unpublished published papers. In fact, in this SI, 80% were from authors unrelated to our conference participants. The guest editors strongly believe that we should reach out to scholars outside our networks to attract high-quality papers from large pools of different communities and networks. We were delighted that this strategy had functioned exceptionally well. We attracted a large number of good quality papers. Eventually, we selected ten papers out of vigorous selection processes and strict peered-review processes. Each paper needs to justify its relevance to this special issue, research contributions, and the novelty in their methodology, approaches, results, analyses and discussions. We also expect the authors of each paper to demonstrate excellent written English. Each can be summed up as follows.

2.1 Exploring the intellectual cores of the Blockchain–Internet of Things (BIoT)

The article on exploring the intellectual cores of the Blockchain–Internet of Things (BIoT) by Tsang et al. (2021) discusses the wealth of research in the fusion of Blockchain and IoT technologies. Integration of Blockchain and the internet of things is the key to achieving the benefits of both technologies. Furthermore, it is an efficient way of developing applications for smart cities, roads, transport, and fuse with cloud and data science. Their study uses an approach known as a co-citation proximity analysis–based systematic review (CPASR) and has conducted correlations between 44 highly influential articles out of 473 relevant research studies. In addition, the authors have adopted a series of statistical analyses, including exploratory factor analysis (EFA), hierarchical cluster analysis (HCA), k-means clustering (KMC) and multidimensional scaling (MDS), to establish the intellectual core. One of their key findings indicates that there are nine cores of intellectual categories.

2.2 The use of Blockchain in the luxury industry: supply chains and the traceability of goods

The article on the use of Blockchain in the luxury industry: supply chains and the traceability of goods by de Boissieu et al. (2021) has developed a novel approach to the utility and contexts influencing the implementation of blockchain technology to optimize supply chain management and prevent fraud in the luxury industry. Luxury

industries are the backbone of growth in worldwide GDP as consumer-driven products and the demand grows exponentially. In fact, most of the investment growth is predicted based on the consumer price index (CPI). Therefore, an article such as this on luxury industry applications is very interesting. They have adopted a qualitative approach based on the grounded theory method. Data are collected by semi-structured interviews with 12 stakeholders working on blockchain applications in the luxury business sector. One of their key findings states that the constraints faced by luxury brands incorporating this technology into their ecosystem include the knowledge gap, the multiplicity of third parties involved in the production process and bias toward short-term returns on investment.

2.3 When technology meets people: the interplay of artificial intelligence and human resource management

The article "When Technology Meets People: The Interplay of Artificial Intelligence and Human Resource Management" by Qamar et al. (2021) has developed an extensive literature survey on the interplay between AI and the Human Resource Management (HRM) domain to identify key issues and challenges in this domain. AI is key to achieving productivity and decision-making. However, a big challenge is the application of AI for HRM remains critical. They have adopted content analysis and structural concept analysis to carry out their research design and applied them to 59 carefully selected journal articles. One of their key findings is a concept map is synthesized to present a taxonomical overview of the AI applications in HRM. One of their research questions is on what is the state-of-the-art research profile for AI applications in the domain of HRM? This is interesting to see the adoption of the research design to identify an answer to these key questions. However, they also have identified some limitations of this study. First, the paper is more focused on providing a broader overview of the domain to open avenues for future research. Second, future research should consider employing advanced techniques such as meta-analysis to provide specific insights into the effect sizes of influence of AI on HRM.

2.4 Blockchain as a mean to secure Internet of Things ecosystems – a systematic literature review

The article entitled "Blockchain as a mean to secure Internet of Things ecosystems – a systematic literature review" is presented by El-Masri and Hussain (2021). The authors conducted a comprehensive review, which is contrasted with findings from ten prior reviews, as they focus on three research questions: existing security threats, conventional security mechanisms; security mechanisms provided by Blockchain; and novel security threats posed by Blockchain. They retained 43 articles covering four layers of Internet of Things (IoT) architecture: perception, network, processing, and application. Numerous security threats, countermeasures, and security mechanisms are classified across a series of IoT-specific security dimensions. The paper concludes that Blockchain technology can be adequately integrated within IoT ecosystems if

architects experiment with various configurations and optimize security mechanisms according to specific requirements. They also call for a more holistic and comparative perspective toward cybersecurity issues in IoT and Blockchain instead of studies specific to only a few threats and countermeasures.

2.5 Consequential factors of Big Data's Analytics Capability: how firms use data in the competitive scenario

The article entitled "Consequential factors of Big Data's Analytics Capability: how firms use data in the competitive scenario" is contributed by Contreras Pinochet et al. (2021). Their focus on Big Data Analytics Capability leads to a proposed model that encompasses Big Data operations, updating IT to enable Big Data, advanced Big Data Analytics skillsets, and the strategic use of Big Data. They use a survey (n = 141) with a PLS model to measure the impact of these capabilities on product innovation performance and how the impact may be mediated by the strength of process-oriented dynamic capabilities, with impact on business value. While the direct relationships between latent variables were all confirmed, the mediating effect was not dominant, with possible implications for the complementary assets required for Big Data Analytics.

2.6 Mitigating information asymmetry in inventory pledge financing through the Internet of Things and Blockchain

The article entitled "Mitigating information asymmetry in inventory pledge financing through the Internet of Things and Blockchain" is contributed by Liu et al. (2021). They employ a multi-case-study approach to analyze the risks to Supply Chain Financing, granted by commercial banks to suppliers and retailers, with inventory pledged as loan collateral. The principal-agent theory is used to classify information asymmetry challenges and identify how Online Financial Service Providers (OFSPs) can take advantage of their direct access to transactional data to improve their risk assessment. Cases demonstrated that IoT could be leveraged to help banks improve inventory accuracy and timeliness. At the same time, its combination with Blockchain and smart contracts prevented artificial tampering and manipulations of paper-type contracts. The paper concludes that the promises of IoT and Blockchain are tangible and will have a significant impact on reducing liquidity risk while ensuring more transparent management of inventory pledges.

2.7 The role of Big Data for Supply Chain 4.0 in manufacturing organisations of developing countries

The article entitled "The role of big data for Supply Chain 4.0 in manufacturing organisations of developing countries" by Narwane et al. (2021) makes a thorough analysis of nine key factors affecting investments in Big Data Analytics (BDA) and their impact on the Supply Chain Performance (SCP). These factors include organizational and top management support, sustainable procurement and sourcing, environmental,

information and product delivery, operational, technical and knowledge, and collaborative planning. They test 10 hypotheses, one per key factor considered and a final one for BDA impact on SCP, based on responses from 321 questionnaires collected across 40 different Indian manufacturing organizations, with respondents managing such departments as Supply Chain, HR, Purchasing, R&D, Production, and Accounting. They compare the performance of both structural equation modeling (SEM) and artificial neural network (ANN) techniques. The study confirms the mediating role of BDA for Supply Chain 4.0 in manufacturing organizations of developing countries.

2.8 Understanding of Blockchain-based identity management system adoption in the public sector

The article entitled "Understanding of Blockchain-based identity management system adoption in the public sector" is contributed by Sung

and Park (2021). As they focus on a specific application and sector, their analysis covers fewer facets of Blockchain technology, but aligns findings on clearly defined requirements for public service delivery. Their main contribution is to clarify to what extent Blockchain-based identity management systems can improve transparency, accountability, and reliability in the user control of one's own data while reducing the time and cost needed to deliver public services as well as increasing administrative efficiency. While their literature review covers international efforts to integrate Blockchain within e-government systems, their main empirical case study is in South Korea's Decentralized Identity (DID) initiative. They review the policy context, adoption process, system design, implementation, and end-user outcomes. Their study concludes that a more outcome-oriented analysis is necessary for research extending beyond the typical technology-driven approach. This can better help identify the best practices for government adoption of new technologies, including Blockchain and others, and link it closely to practical implications.

2.9 Emerging digital economy companies and leading cryptocurrencies: insights from Blockchain-based technology companies

The article entitled "Emerging digital economy companies and leading cryptocurrencies: insights from Blockchain-based technology companies", by Asl, Rashidi, and Abad (2021), may require more effort from readers, but will prove valuable learning. Its focus is on assessing and forecasting the business value of Blockchain applications in cryptocurrencies as perceived by financial markets. Their dataset includes the daily prices of four S&P Kensho New Economy Subsector Indices, namely Digital Communities Index, Alternative Finance Index, Democratized Banking Index, and Future Payments Index. They also rely on the prices of eight cryptocurrencies, including Bitcoin, Ethereum, Litecoin, Ripple, Tether, Monero, Dash, Stellar and Peercoin, all during the period from August 11, 2015, to February 10, 2020. They apply stochastic simulations for time series modeling to investigate the interconnection between the leading cryptocurrencies and four groupings of emerging digital

companies traded on stock markets. Their results show the positive role of cryptocurrencies in improving financial services, suggesting managers and regulators pay more attention to the usefulness of cryptocurrencies and Blockchains instead of their traditional speculative potential. Since they focus on two of the four sectors, Alternative Finance and Democratized Banking, they show that their success depends on a positive interconnection with cryptocurrencies. Their findings show an original contribution in assessing the financial value of Blockchain technology. The authors' contribution also helps refocus attention on the actual outcome of crypto instead of excessive focus on potential adoption, which has been the leading criteria to judge relevance in making strategic choices for technology adoption.

2.10 Deep learning-based affective computing

The final article of this special issue, entitled "Deep learning-based affective computing" by Kumar (2021), presents an affective computing model to classify emotions and sentiments using both text and image-based data. The study used customized deep learning models for affective computing. For instance, text-based affective computing was conducted on four standard datasets using three deep learning customized models: LSTM, GRU, and CNN. Similarly, the image-based affective computing was done on the data extracted from Instagram using three deep learning models: CNN, transfer learning with VGG-19 model and transfer learning with ResNet-18 model. The study also used four variants of deep learning, including the LSTM model, LSTM model with GloVe embeddings, Bi-directional LSTM model and LSTM model with attention layer for text-based classification. The results of the study suggest that the proposed methods can be effectively used for affective computing for both text and image-based data and can aid in decision-making.

3. Discussions

3.1 Meeting the objectives of this special issue

The objectives of this special issue and its rationale are discussed as follows.

• **Bring together researchers and research practitioners in emerging trends and impacts of AI, Data Analytics and Blockchain:** The guest editors have received papers from different research groups and communities. 80% of selected authors were not related to the confernece. We are delighted to learn and understand different types of research projects and bring all of them together.

• **Develop pioneering methods, techniques, theories and services for AI, Data Analytics and Blockchain and its integration:** We have selected some papers that authors have clearly explained how they have developed novel methods, techniques, theories and services. They have presented different methodologies and approaches for AI, Data Analytics and Blockchain. For integrations, some authors only have integrated two of these altogether.

• **Demonstrate the effectiveness of the adoption cases, recommendations and real-world solutions for AI, Data Analytics and Blockchain and its integration:** All authors have clearly explained how their work can offer the effectiveness of the adoption cases, recommendations and real-world solutions. All authors have presented their findings, insights and research contributions in lively and interesting ways.

• **Strengthen the innovation and development for AI, Data Analytics and Blockchain integration, and development of its related areas such as Software Engineering, IoT-Fog-Edge-Cloud Computing and Cybersecurity:** Some authors have offered deep discussions their lessons learned. Sharing such information can be useful not only for the JEIM journal but also for other research communities.

3.2. Future Research Directions and Guest Editors' views

Based on observations and insights from the guest editors and our selected authors, we have identified the following areas as the future research directions with rationale as follows. They can be classified as per two categories that cover both micro and macro aspects of technology strategy. First, to what extent will enterprise IT evolve given the increasing adoption of AI, Data Analytics, and Blockchain. Second, as these trends coalesce with other social and economic changes over the next decade, to what extent will they trigger a renewed systemic effects or global digital disruption, similar in scale to the transformation brought on by the World Wide Web in the mid-1990s. We take the viewpoint of a long-term research agenda planning process.

As exemplified by articles 3 and 10 in this special issue, dealing with HRM and affective-behavioral applications, recent advances in AI over the past five years have demonstrated its enduring impacts. Numerous pilot projects have been initiated by organizations of all sizes and in all sectors, going well beyond traditional Machine Learning applications. Several new algorithms and applications have been derived from foundational advances in Deep Learning (DL). Whether applied to semantic analysis, knowledge graphs, or other forms of knowledge representation, DL will continue to be a source of valuable applications. However, more research is required to integrate these findings with more complex and evolutionary technologies, such as Robotic Process Automation (RPA), and especially Multi-Agent Systems (MAS). These AI technologies have not yet been extensively adopted, but their potential, when combined with DL, can significantly improve learning, inference, reasoning, and coordination of complex business processes.

Among those we retained for publication, articles 5 and 7 demonstrate the impact of Big Data Analytics (BDA) well. While benefiting from renewed investments in AI, BDA has its own momentum for renewed applied research, as it is a renewed effort beyond existing capabilities for Business Intelligence and Predictive Analytics. Most organizations still need to invest in proper cloud infrastructure to overcome the volume, velocity, and variety of challenges caused by big data. However, the relative commoditization and interoperability of BDA software will surely allow adopters of all sizes and spur innovative uses of more real-time data across business processes. Therefore, more research will be required to

integrate BDA innovations within the fabric of enterprise IT properly. As research in Information Systems has demonstrated well, organizations must develop the capability to generate knowledge and intelligence embedded in their business processes. Hence, BDA may lead to a more complex research agenda addressing such issues. This is particularly true in real-time intelligence from big data, transferring analytics findings to business rules, and maintaining an increasingly frequent rate of change, or digital transformation, of business processes, while combining more agile methods with BDA and business rules development.

Finally, among the three technologies of this special issue, the most important is represented by articles 1, 2, 4, 6, 8 and 9. Blockchain has become a dominant emerging platform and service compared to other related areas. Blockchain is not only a hot topic but is also widely adopted in many sectors and disciplines. Therefore, it is highly valuable to know lessons learned and recommendations to overcome the challenges of using Blockchain, which will become pervasive in our daily lives, such as financial services, supply chain, education and other service-oriented industry. Nevertheless, Blockchain has significant impacts on the ways people have lived and interacted.

The micro-level research agenda of AI, Data Analytics, and Blockchain can be integrated within a macro-level overview that links to their disruptive effects throughout societies and economies globally. As organizations in all sectors progressively adopt more interactive, reliable, transparent, and explainable AI, people will gain greater value from digital technologies in both their workplaces and lifestyles. Once AI becomes more tightly integrated with BDA, Blockchain, and other technologies such as the Internet of Things, their innovative combinations may give rise to major industry disruptions. More exploratory research is necessary, especially through in-depth case studies, to uncover the potential for the emergence of these innovative business models. Hence, a macro-view of digital innovation must emerge and may eventually become a dominant force as digital transformation has become in the past few years.

4. Conclusion

We have selected ten papers and justified research contributions for each paper. We have explained how our scientific contributions also meet the objectives of this special issue and have described our views and recommendations on future research directions. We are grateful for the opportunities to serve the JEIM community. We particularly thank the Editor-in-Chief, Emerald publisher, Journal manager, reviewers, and contributors for making our special issue happen.

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